



Survival Factors

Airbag Safety Study Factual Report

May 20, 2009

Location: Steamboat Springs, CO
Aircraft Type: SR-22
Accident Date: 2/14/09
Accident Time: 1115 MST
Accident Number: N486CD, CEN09LA165
Airbag Equipped: Yes

Group Members:

NTSB Group Chairmen:

Jana Price
Courtney Liedler

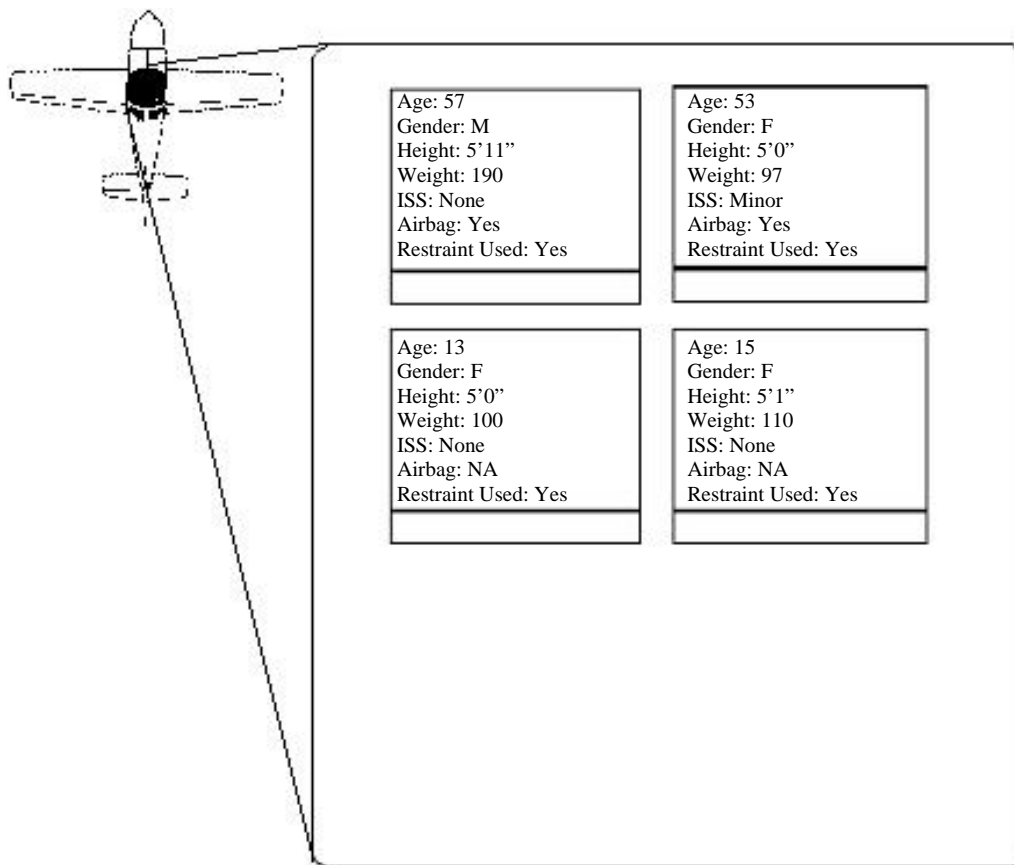
Additional Members:

Tom Barth, AmSafe
Brad Miller, Cirrus
Arnold Scott (NTSB IIC, Did not launch to scene)

Summary

On February 14, 2009, approximately 1115 Mountain Standard Time, a Cirrus SR22, N486CD, registered to and operated by Vector Resources LLC, Denver, Colorado, was substantially damaged when, during an attempted go-around, it struck a snow berm and nosed over at Bob Adams Field (SBS), Steamboat Springs, Colorado. Visual meteorological conditions prevailed at the time of the accident. The personal flight was being conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91, and a visual flight rules (VFR) flight plan had been filed. The pilot and two rear seat passengers were not injured; the front right seat passenger received minor injuries. The cross-country flight originated from Centennial Airport (APA), Englewood, Colorado, approximately 1015, and was en route to SBS.

The pilot said he landed on runway 32. The pilot reported that during the landing roll, he believed that the airplane hit a patch of ice and turned sideways. The pilot decided to make a go-around. According to airport staff, as the airplane lifted off, the landing gear struck a 19-inch snow berm 49 feet from the end of the runway and the airplane nosed over. The front seat occupants' restraint airbag systems inflated. The vertical stabilizer was torn off the airplane, and the horizontal stabilizer was buckled.

Seating Chart:**Aircraft Damage:**

See figures 1 and 2 for an overall view of exterior damage. There was wing tip damage and skin damage to both left and right wings. The left wing tip exhibited impact damage with an approximate 45 degree buckle from the forward outboard tip angling inboard on both the upper and lower skins of the wingtip. The right wing tip exhibited impact damage and aft buckling at the leading edge. The lower skin of right wing tip had a 45 degree buckle starting on inboard leading edge of tip extending outboard.

The nose of the airplane was shifted to the left including the engine, propeller, and spinner (Figure 3). The spinner had aft crushing with soil embedded in folds of metal. All three blades had aft bending at about 10" from the hub and one blade had chordwise scratching on the outboard 6" of blade, and gouges on the leading edge. This blade also had spanwise scratching from hub outboard to within 6" of blade tip.

The oil pan was crushed and nose landing gear was separated from the engine mount at the polymer puck-stack assembly and folded back underneath the fuselage but remained attached at the lower hinge points. The firewall did not show signs of buckling and the cabin portion of the fuselage had no impact damage.

The vertical stabilizer and rudder separated from empannage. The elevator separated at outboard hinge point.



Figure 1- An on-scene photograph of the inverted accident airplane looking at the right side of the aircraft.



Figure 2 – A post-recovery photograph of the front and left side of the aircraft.



Figure 3 – A post-recovery photograph of the front of the aircraft showing the nose/engine displacement

Overall, there was very little interior cabin damage. The headliner was torn back and displaced. On the left side, the sun visor shattered and there was a small amount of blood on the windscreen at pilot eye level. (Figure 4). There was also a small displacement of left bolster panel/center console (Figure 5).

On the right side, there were many blood stains, mostly on right front side and inside right door (Figure 6). There was a blood stain on right headliner near the grab-handle and eyeball light 14" wide and 4" front to aft. There were small blood spots on bolster and inside right portion of console at level of the transponder. There was also a small spot on right bolster panel lower edge to the left of the "grab here" placard (Figure 7). The right front door window was broken in a V-shape (Figure 8) and the pilot stated that he had broken the window with the egress hammer from the left seat.



Figure 4 – Left side photo shows headliner with bloodstains, and broken sun visor on left side. Right side photo shows blood stain on windscreen, which is obscured behind the broken sun visor on left side photo.



Figure 5 – Displacement of left bolster panel/center console.



Figure 6 – Blood stains on inside of right front door.



Figure 7 - Various blood spots on the right front interior side of the cabin.



Figure 8 – Broken right front window. (This window was used for egress.)

Seats

Overall, there was no seat displacement and very little damage to seats in general with the exception of slight deformations of the forward edges of the energy absorption modules on both right and left front seat pans, which are listed below.

Left seat: front right corner deformed 0.3", mid point deformed 0.4", left front corner deformed 0.2".

Right seat: left front corner deformed 0.25", center deformed 0.3", right front corner deformed 0.15".

Both left and right front seats measured: seatpan width 17", seatpan depth 18.75", Seatback height 27.5", seatback width 15.75"

Both left and right back seats measured: seatpan width 18", depth 19", seatback width 19", seatback height 28".

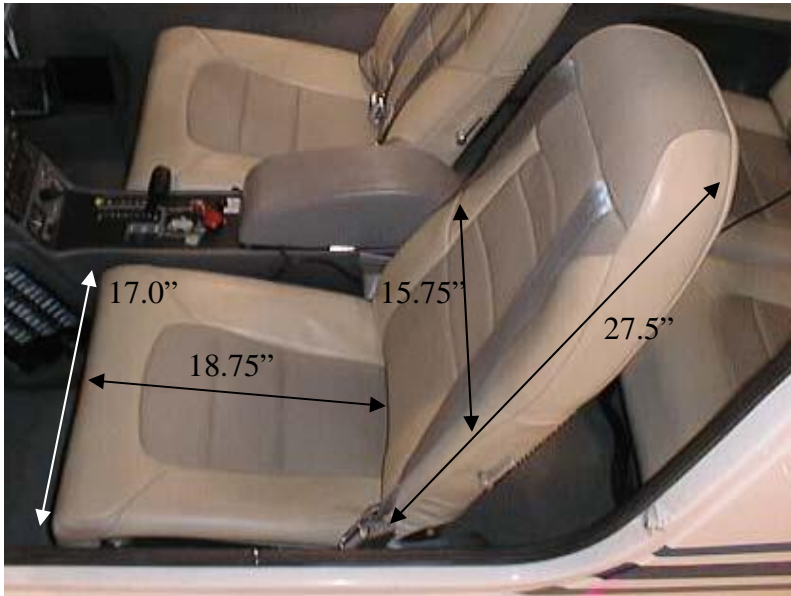
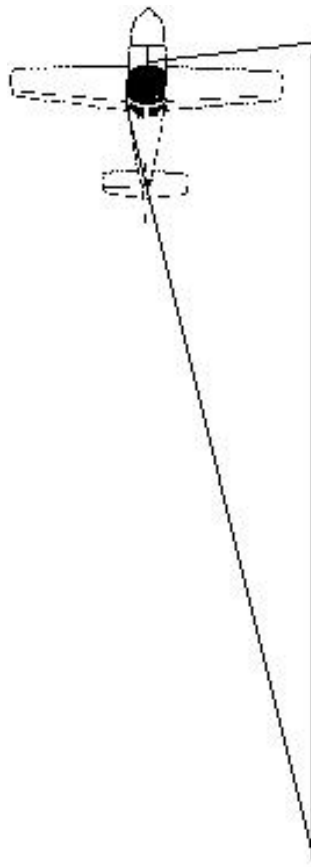


Figure 9: Dimensions of the front seat (exemplar photo).

Seat Numbers:



| | |
|--|--|
| Seat Manufacturer: Northstar Aerospace P/N: 20907-003 S/N: 3168 | Seat Manufacturer: Northstar Aerospace P/N: 20907-004 S/N: 3167 |
| | |
| Seat Manufacturer: P/N: S/N: | Seat Manufacturer: P/N: S/N: |
| | |



Figure 10 – Front Seats



Figure 11 – Rear seats.

Restraints:

The accident aircraft was equipped with four-point restraint systems at all four seating positions. All four restraints and their corresponding inertial reels were undamaged.

On the left front seat, the load bar on the buckle side was located 16.5" from the center of the anchor bolt. On the connector/tongue side, the load bar was located 19.5" from the center of the anchor bolt. Witness marks on the belts corresponded to load bar locations, with heavier witness marks on the buckle side.

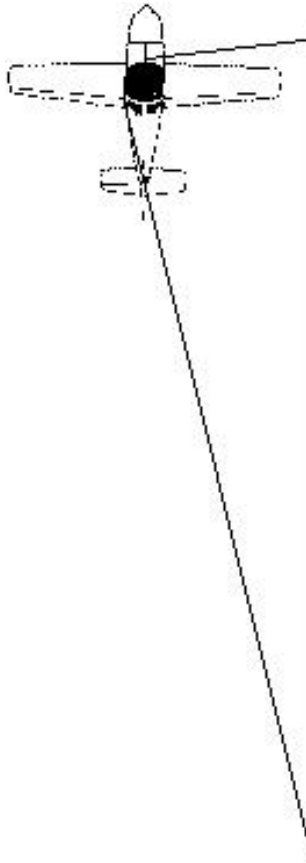
On the right front seat, the load bar on the buckle side was located 15.5" from the center of the anchor bolt. On the connector/tongue side, the load bar was located 16.5" from the center of the anchor bolt. Witness marks on this side also corresponded to the load bar locations.

On the right rear seat, the buckle side load bar was located 20" from the cushion and the connector/tongue side load bar was 22" from the cushion (i.e., fully extended). There were small witness marks at the full extension (2.5" from end) suggests that it was being worn at the time of the crash

On the left rear seat, the buckle side load bar was located 15.5" from the cushion, and the connector/tongue side load bar was located 17" from the cushion. There were very faint witness marks on the connector/tongue side 7" from end of belt. Several heavier witness marks on buckle side starting at 4.5" from end of belt to 8" from end of belt.¹

¹ The witness mark pattern was atypical because it was extended, with several marks for over a 3.5" span of the restraint. In previous accidents (and on the other restraints in this accident), there have been 3-4 marks that corresponded to the edges of the load bar. One possible explanation is that the belt may have loaded up, then slipped through some distance, then loaded again.

Restraint Numbers:



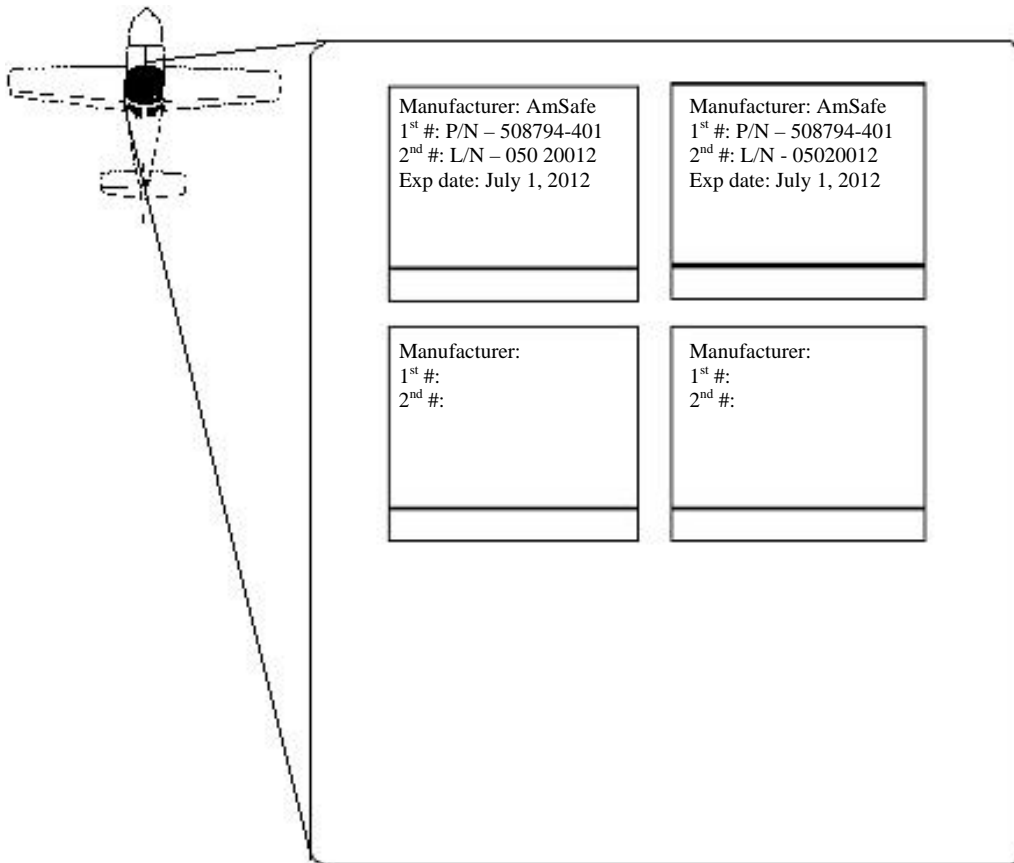
| | |
|--|--|
| Restraint Manufacturer: Amsafe Harness Type: 4-point Assy: M# 7041-1-011-2396 Date: M 08 05 | Restraint Manufacturer: Amsafe Harness Type: 4-point Assy: M# 7041-1-021-2396 Date: M 08 05 |
| Restraint Manufacturer: Harness Type: Assy: M#: | Restraint Manufacturer: Harness Type: Assy: M#: |

Note: Rear Seat Inertial Reel Part # A/N 4089-1-011-2396, Date A-06-05

Airbags:

The two front seats were equipped with restraint mounted airbag systems that deployed from the outboard shoulder harness. The airbags are in the shape of an inverted L. Both front seat airbags deployed. On the left front airbag, the seams were observed to be intact with no stitching damage. On the instrument panel side of the airbag (Figure 12), there was a small blood spot next to the lower lobe vent hole approximately 7" from bottom of bag. There was no squaring of the bottom vent hole and minor squaring (3 to 4 threads) of the top vent hole. On the occupant side (Figure 13), there was a 0.5" in diameter blood spot 3" from the outboard edge and 6" from the top. There were also black scuff marks from 2.5" to 4" from the top of the bag at 5" from the outboard edge of the bag.

On the right front airbag, the seams were intact. On the instrument panel side (Figure 14), both the upper and lower vent holes had minor squaring (2-3 threads). There were also some small scuff marks on the instrument panel side. On the occupant side (Figure 15), there was a large amount of blood and two scuff-marks: The first scuff mark was 1.5" from the outboard edge to 3.5" from the outboard edge starting 10" down from the top to 12.5" from the top. The second scuff mark was 6" from the outboard edge to 8.5" from the outboard edge and 12" down from the top to 14" down from the top. Finally, there were a few tiny blue spots on the bag.

Inflator Assembly Part Numbers:

| |
|---|
| Manufacturer: AmSafe 1 st #: P/N – 508794-401 2 nd #: L/N – 050 20012 Exp date: July 1, 2012 |
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|--|
| Manufacturer: AmSafe 1 st #: P/N – 508794-401 2 nd #: L/N - 05020012 Exp date: July 1, 2012 |
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| Manufacturer: 1 st #: 2 nd #: |
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| Manufacturer: 1 st #: 2 nd #: |
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Figure 12 – Left front airbag, instrument panel side.



Figure 13 – Left front airbag, occupant side.



Figure 14 – Right front airbag, instrument side. Right side photo shows detail view of small scuff marks.



Figure 15 – Right front airbag, occupant side.

Medical/Autopsy Information:

Information about occupant injuries came from interviews conducted with the pilot (left front seat) and his wife (right front seat) on February 15, 2009. According to the pilot, he and his daughters were completely uninjured as a result of the accident, although he did sustain a minor cut on his finger while exiting the airplane through the broken window. The pilot's wife was injured and was assisted by emergency medical technicians on scene. He said they refused transportation by ambulance to the hospital but they borrowed the crew car from the airport to drive to the local hospital. X-rays were conducted on his wife, all of which were negative.

The pilot's wife (right front seat occupant), who is a physician, reported that her injuries were mild, including a bloody nose. She stated that she used to get bloody noses a lot due to dry climate and allergies, but had not experienced them recently. She said that the nose bleed that resulted from the accident did not come from a cut on the surface of the nose, but rather from the inside. She also said that her nose was bruised on the bridge from the inner campus to the right inner campus. Initially she thought her nose was broken, but X-rays proved otherwise. She said she also had some abrasions and some chin bruising.

Other injuries to the right front seat occupant included a bruise on her chest around the place where the harness buckle sat, between her 3rd and 4th rib, at about the midpoint of her chest.² She thought the rib might be broken, but again the x-rays were negative. She also injured her left hand and said that she must have burst a blood vessel on her hand because the pad between the base of her thumb and her wrist swelled to twice its normal size. She said she was not sure what her hand came in contact with to cause the injury. She was released from the hospital after getting the X-ray results. She reported that she did not have any residual neck soreness as a result of the crash and never filled her prescription for pain medications but instead took some over-the-counter anti inflammatory drugs.

| Occupant Location | Gender | Age | Height | Weight | Description Of Injuries | Injury Classification |
|----------------------------|---------------|------------|---------------|---------------|--|------------------------------|
| 1 st Row, Left | M | 57 | 5'11" | 190 lbs | | None |
| 1 st Row, Right | F | 53 | 5'0" | 97 | Bloody nose, small chin bruise, small chest bruise, sprained left hand/wrist | Minor |
| 2 nd Row, Left | F | 13 | 5'0" | 100 | | None |
| 2 nd Row, Right | F | 15 | 5'1" | 110 | | None |

² A follow-up interview with the right front seat occupant confirmed that she routinely adjusted her seat harness so that the buckle sat just below her breastbone.

Other Information:

MFD/PFD Identifiers:

Part # 700-00004-xxx()

Serial # 21383285 Rev 00, no mods

Part # 700-00006-000 Rev 40, Mod 47, 45

Serial # 20027397

Flash Card Flash Part #: 053-00180-100, Rev 00

Contains software 530-00180-100, Rev 00